INFILTRATOR® SYSTEMS INC

Environmental Onsite Wastewater Solutions℠

September 12, 2006

John J. Aulbach II, P.E.
Virginia Department of Health
Division of Onsite Sewage and Water Services
131 Walker Street
Lexington, Virginia 24450

Re: Request for Modification of GMP 116 Relating Substitution of Non-Gravel Trench Drainfields

Dear Mr. Aulbach:

Infiltrator Systems Inc. (ISI) has welcomed the opportunity to provide input to the Virginia Department of Health (VDH) in the development of general memorandums of policy (GMPs 116 and 127) on the use of non-gravel drainfield systems.

ISI recognizes the national leadership of VDH and is likewise proud of our environmental and market leadership. Over the past twenty years, over 2.0 million onsite systems using ISI chambers have been installed on the United States and Canada. Last year, more than one in every four onsite systems installed in the United States and Canada was an ISI chamber system. These chamber systems are typically 50 to 60% the size of gravel drainfield systems. ISI systems are notably effective in preserving non-renewable natural resources such as fossil fuels and natural aggregate.

As you know, the current GMP 116 allows for a 50% bottom area reduction when non-gravel systems are used subject to a waiver and various conditions. Since April of 2002 when the GMP 116 was issued, over 20,000 drainfields using Infiltrator chambers sized in accordance with GMP 116 have been installed in Virginia with a very low rate of reported system malfunctions. A detailed year-by-year summary is included in table 1.

Year	Number of ISI GMP 116 Systems Installed	Number of Reported Malfunctions
2002	1,264	2
2003	3,247	3
2004	5,546	8
2005	6,459	11
2006 (thru August)	3,706	11
Total	20,222	35 (0.2%)

Based on the successful performance record of these systems and the research described below, Infiltrator Systems, INC. (ISI) requests modification of GMP 116 to eliminate the requirements for owner and AOSE sign-off and eliminate specific trench length requirements when a limited reduction in total trench length (15 – 25% dependent on soil type) is utilized. Note that ISI remains willing to continue to offer the full five-year performance warranty and financial assurance stipulated in GMP 116.

A suggested modified version of the current GMP 116 is attached (Attachment 1). ISI is also open to working with the Department to modify GMP 127 or to develop a new GMP to meet this intent.

In support of these proposals we would ask your consideration of the following points, which are explained in more detail later in this letter:

- **Science-based approach to gravel-less chamber system sizing** – The requested sizing factors (15% - 25% gross area reductions) are well within the range of sizing criteria identified by third-party peer reviewed research.

- **Field performance study results** – Field data demonstrate that gravel-less chamber dispersal systems with a 50% sizing reduction operate as successfully as conventional rock dispersal systems.

- **Current VDH policy** – The current policy (GMP 116) allows for drainfield bottom area reductions of to 50% when specific requirements are met.

- **National acceptance of chamber sizing** – Nationally, policy in 48 of 50 states permits a reduction in dispersal system sizing of up to 50 percent. In addition, the International Association of Plumbing and Mechanical Officials (IAPMO) Uniform Plumbing Code (UPC) includes gravelless leaching chambers when installed with a 0.70 area multiplier (30% area reduction).

To support ISI's request, this letter provides information on the following topics that pertain to chamber dispersal system sizing in Virginia.

- Infiltrator chamber systems technology summary
- Recent research supporting gravel-less dispersal system sizing
- Field performance studies on gravel-less chamber systems
- ISI's Virginia business, consumer choice, and effect of policies

Infiltrator Chamber Systems Technology Summary

The products manufactured by ISI are gravel-less leaching chambers consisting of a chemically inert blend of recycled polyolefin resin. Chambers are buried structures used to create an enclosed unobstructed bottom absorption area (also referred to as an open infiltrative surface) and side-wall absorption area for infiltration and treatment of wastewater (Attachment 2). These systems can be used to replace a conventional rock and distribution pipe dispersal system. In this application, the term "unobstructed" means that the bottom of the trench on which the chamber is installed does not contain rock that impedes the passage of wastewater into the soil/biomat infiltration surface.

Chamber systems consist of interlocking segments that have end caps at the inlet and distal ends of a row. The top of the chamber, or dome, is solid, while the sidewalls are louvered. The louver design allows wastewater to exfiltrate from the chamber, while resisting soil particle intrusion into the enclosed unobstructed soil bottom.

Technical literature for one of the chamber models that ISI sells in Virginia, the Quick4 Standard chamber, is provided in Attachment 2. These chambers have tested by an independent laboratory and

have been reviewed and accepted for listing by the Product Research Committee of IAPMO Research and Testing, Inc. as meeting the physical, chemical, and structural requirement of the Unified Plumbing Code (Attachment 3). Note that the Unified Plumbing Code defines chamber systems at 70% of the size of gravel drainfields as an equivalent to a 100% gravel drainfield.

An additional technology summary is provided in the United States Environmental Protection Agency Technology Fact Sheet on Septic Tank Leaching Chambers (Attachment 4). This document includes chamber system sizing guidance based on North Carolina regulatory policy:

> *The minimum footage of a leaching chamber system should be determined by dividing the total trench bottom area by 1.2 meters (4 feet), when used in a conventional trench.*

Dividing total trench area by 4 feet allows for 25% trench length reduction for chamber systems (compared to a 3' wide gravel trench).

To the extent you have any technical questions or concerns, we would be happy to speak with the appropriate member of the VDH staff.

Gravel-less Chamber Dispersal System Technology and Virginia Policy

For household on-site wastewater treatment systems, a variety of technologies exist for delivering wastewater to soil. Traditionally, health departments have permitted rock-filled trenches with plastic distribution pipe for providing additional treatment and reintroducing domestic wastewater to the ground. Within this system, wastewater enters the trench and infiltrates into the native soil through the voids present in the stone. Water is conveyed through such a trench via a perforated plastic pipe. Naturally occurring biological activity at the soil/dispersal system interface and in the soil that underlies the trench provides additional treatment. This method of wastewater treatment and dispersal is used in all 50 states.

More recently, research into the science of wastewater infiltration has led to improved systems for wastewater dispersal. One such technology includes gravel-less chamber systems. These systems eliminate the use of stone and pipe, and substitute the traditional stone trench with plastic products. One of the consequences of this innovation is that the delivery of wastewater into soil can be achieved more efficiently than in a stone and pipe trench, resulting in the need for comparatively smaller wastewater dispersal systems. Where smaller wastewater dispersal systems are employed, they are commonly referred to as "sizing reductions" or "length reductions". Regulatory bodies in Virginia and nationwide have permitted such sizing based on scientific research and field investigations that show equivalent or better performance for gravel-less technologies, as compared to rock and distribution pipe.

The availability of gravel-less chamber technology and its sizing conventions provides the Virginia consumer with another choice for constructing a wastewater dispersal system. Depending upon the price of crushed rock, gravel-less chamber system can provide distinct cost advantages, providing cost savings to homeowners, compared to the cost of installing a rock and distribution pipe dispersal system. In addition to reducing expense, gravel-less chamber systems can reduced the time associated with trench excavation and dispersal system installation compared to a rock and pipe dispersal system.

Current Gravel-less Chamber Research

The scientific basis for gravel-less chamber sizing has been recently investigated and reported on by the Colorado School of Mines' (CSM) Environmental Science & Engineering Division. The results of this work were published in a juried (peer-reviewed) article that appeared in the Winter 2004 edition of *Small Flows Quarterly*, "Wastewater Infiltration into Soil and the Effects of Infiltrative Surface Architecture." A copy of this article is provided in Attachment 5.

One of the key findings by the CSM researchers is that the long-term acceptance rate (LTAR) for wastewater through an open infiltrative surface, such as a chamber, is 1.5 to 2.0 times higher than the LTAR for an infiltrative surface that is obstructed with solid objects, such as rock or synthetic aggregate in a trench. In other words, a chamber system that is 50% to 67% of the length of a gravel system (as compared to the 75% - 85% sizing factor proposed) will provide the same infiltrative capacity as a full-length gravel system. Based on observations made in three recent research projects, the CSM authors conclude the following:

> *The implications of these results are that a wastewater soil absorption system employing a chamber outfitted trench design can be sized with a smaller soil infiltration surface area compared to that required for a gravel-filled trench design (or similar solid-object laden infiltrative surface design).*

Walsh further evaluated infiltrative capacity as effected by infiltrative surface architecture (ISA) in his masters thesis published as partial fulfillment of the requirements for a Master of Science (Environmental Science and Engineering) at CSM (Attachment 6). The author concluded the following:

> *The open [no gravel on soil interface] ISA had a higher infiltrative capacity than the gravel-laden ISA at the end of the project for columns receiving STE [septic tank effluent]. The ratio of open ISA to gravel-laden ISA mean final acceptance rates was 3.2. This has implications suggesting that open ISA would have more favorable long term hydraulic behavior when applying STE.*

Field Performance Studies

Gravel-less chamber dispersal system performance was determined to be as reliable as conventional rock and distribution pipe in a study conducted in the state of Oregon. As a component of ISI's Equalizer 24 chamber (which is also approved for use in Virginia) approval in Oregon, the Oregon Department of Environmental Quality required the performance of a third-party field study comparing chamber and rock and distribution pipe system performance. This study was conducted by Dr. Larry King and Dr. Michael Hoover at North Carolina State University, in conjunction with regulators from the Oregon Department of Environmental Quality. A juried article summarizing the study results was published in the Fall 2002 edition of *Small Flows Quarterly.* A copy of the *Small Flows Quarterly* article is provided in Attachment 7.

The study of over 400 chamber (consisting of ISI's Equalizer 24 model) and rock and distribution pipe systems concluded that failure rates for chamber systems and rock and distribution pipe dispersal

systems were less than 1.5 percent. Chamber systems in this study were installed with basal area reductions of 40 percent.

Uebler et al presented the results of a study conducted by the North Carolina Department of the Environment and Natural Resources (NCDENR) at the 2006 National Onsite Wastewater Recycling Association (NOWRA) 2006 Technical and Education Conference (Attachment 8). This study compared the performance of chamber and other non-gravel systems with a 25% trench length reduction to conventional gravel systems. A total of 912 systems were randomly selected and evaluated in six counties across the state. Systems were grouped and compared in three age groups (2-4 years, 5-7 years, and 8-12 years). The statewide failure rates of both chamber and non-gravel systems with 25% trench length reductions compared to conventional gravel systems were not statistically different at a 95% confidence level. NCDENR policy (Attachment 7) allows for chamber substitution (installed with a 25% trench length reduction) for gravel systems without additional homeowner or designer written approval. These chamber systems are deemed "accepted" and are equivalent to conventional gravel systems from a permitting perspective. The suggested modifications to GMP 116 are intended to establish a similar policy in Virginia.

The following third-party publications provide additional support for the use of ISI chambers installed with a gross area reduction as compared to the size of a rock and distribution pipe dispersal system. These publications are also included in Attachment 9.

A. A Review of Literature and Computations for Chamber-Style Onsite Wastewater Distribution Systems, (2001), Timothy Burcham, P.E., Ph.D., Mississippi State University.

   The Mississippi Department of Health commissioned this research report. It includes a literature review of fourteen technical documents on chamber performance. Dr. Burcham also presents a computer model comparing the performance of chamber systems and gravel systems. Dr. Burcham concludes that at 50% sizing, chambers can provide an added factor of safety compared to aggregate systems.

B. Final Report – Infiltrator Florida Side-By-Side Test Site, Killarney Elementary School, (1997), Nodarse & Associates.

   This third-party study conducted by the engineering firm Nodarse & Associates for the State of Florida included a side-by-side multiple replicate field test to compare performance of chambers to traditional gravel trenches. The measured acceptance rate of the 22" wide chamber (Equalizer 36) was 2.3 times that of the 36" wide gravel trench (1.6 gpd/sf versus 0.7 gpd/sf). This research indicates that chamber systems with gross area reductions in excess of 50% are as efficient as full-sized gravel-filled trenches.

C. Review of Chamber Systems and Their Sizing for Wastewater Treatment Systems, (2001), Douglas Joy, Ph.D., University of Guelph.

   This paper provides a research summary and an appropriate sizing formula for chamber systems. Based on the equivalent sizing formulas on page 11, a 22" wide (Equalizer 36) chamber installed at 63% of the length of a 36" wide gravel system provides equivalent performance to a full-length gravel system.

ISI's Virginia Business, Consumer Choice, and Effect of Policy

ISI manufacturers its chambers domestically, and sells these products through 32 distribution locations in Virginia. These distributors are typically plumbing and building materials supply companies. ISI's distributors typically sell chamber products to contractors whose principal business is the construction of septic systems, including the wastewater dispersal system component discussed in this letter.

Contractors and homeowners can benefit directly from inclusion of the proposed GMP language. Consumers and contractors will be provided with a potentially lower-cost alternative to wastewater dispersal system construction than is available through rock and distribution pipe. Another benefit to homeowners is ISI's performance warranty, something not provided for a rock and distribution pipe dispersal system. In speaking with the County Environmental Health officials, it was important to them that a large and experienced company supplies and warranties these non-gravel systems.

A benefit to Virginia's natural resources reserves can also be realized through inclusion of the proposed GMP language. Gravel-less wastewater dispersal systems are installed in lieu of crushed rock aggregate. This aggregate is typically mined at a rock quarry, processed at the quarry to achieve a specific size requirement and wash fine particles from the rock surface, and delivered to a construction site for placement in a trench as part of a wastewater dispersal system. Alternatively, chambers are a recycled plastic product used as a substitute for rock, conserving a valuable, non-renewable natural resource. This product substitution allows the state's natural aggregate reserves to be preserved for use in asphalt, concrete, road bases, etc. In addition, the mining, processing, and delivery of crushed rock is an energy-intensive process, placing an added demand on Virginia's electrical generation and petroleum resources. These energy-intensive activities also produce detrimental air emissions that contribute to poor air quality, which can be reduced by reducing the reliance on crushed rock for dispersal system construction.

Summary and Conclusion

Given widespread use of the gravel-less chambers with a 50% size factor in most counties in this state and nationally, the superb success rate of these systems, the space and cost saving advantages of this technology, the environmentally-friendly aspects of gravel-less chambers, and the solid peer review results we have presented in this letter, we see no reason that VDH should not include the proposed language into GMP 116 (or develop an alternate GMP to meet the same intent). The advantages provided by these alternative systems at a conservative size (25% reduction as opposed to sizing in accordance with research supporting a 50% reduction) provide numerous benefits to state homeowners requiring the use of a septic tank system.

Thank you very much for your consideration on this issue. Please contact me at (860) 577-7106 if any further information is required.

Very truly yours,

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